Possible Papers & Progress

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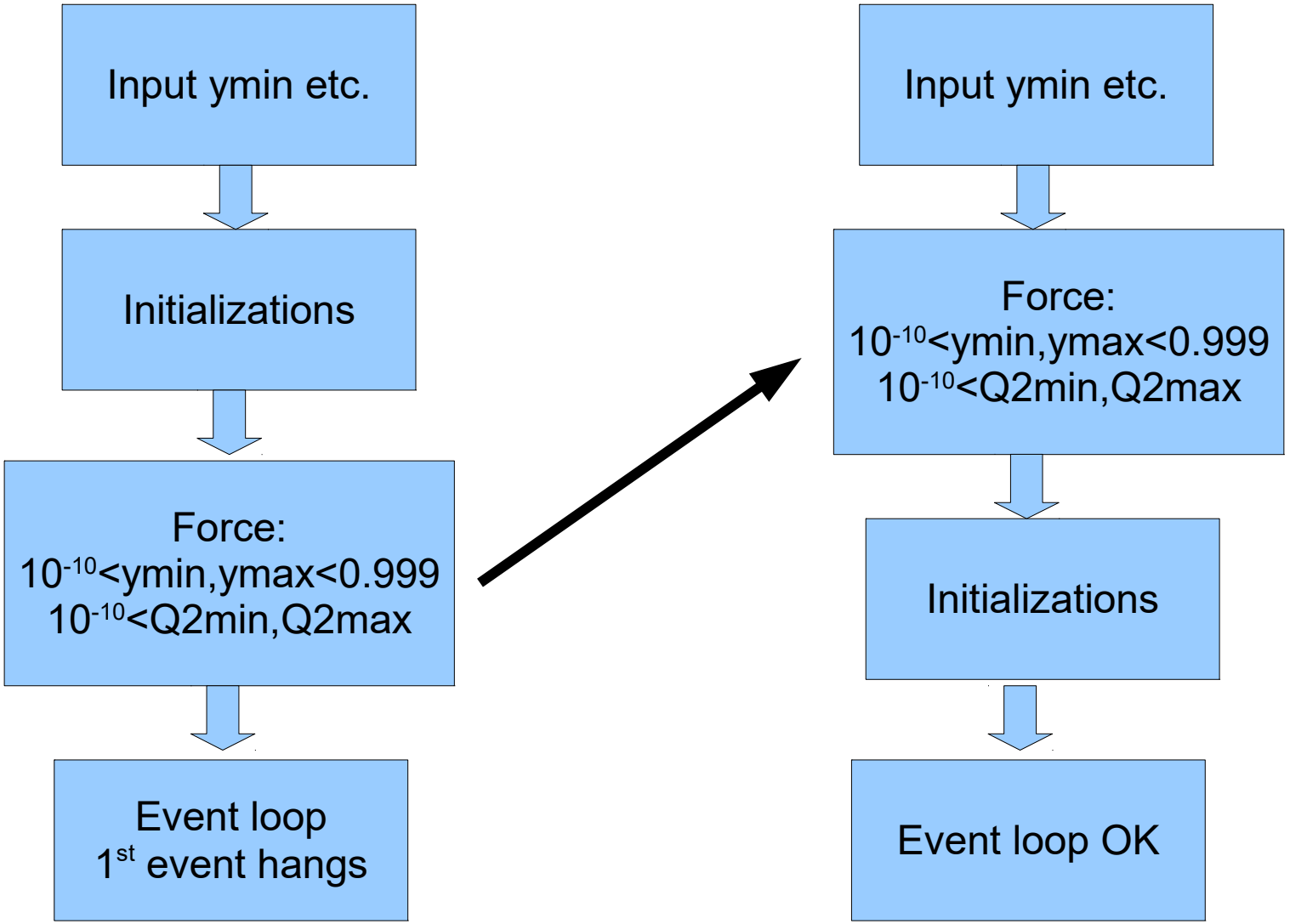
April 15, 2019

Note: Just a quick overview today.

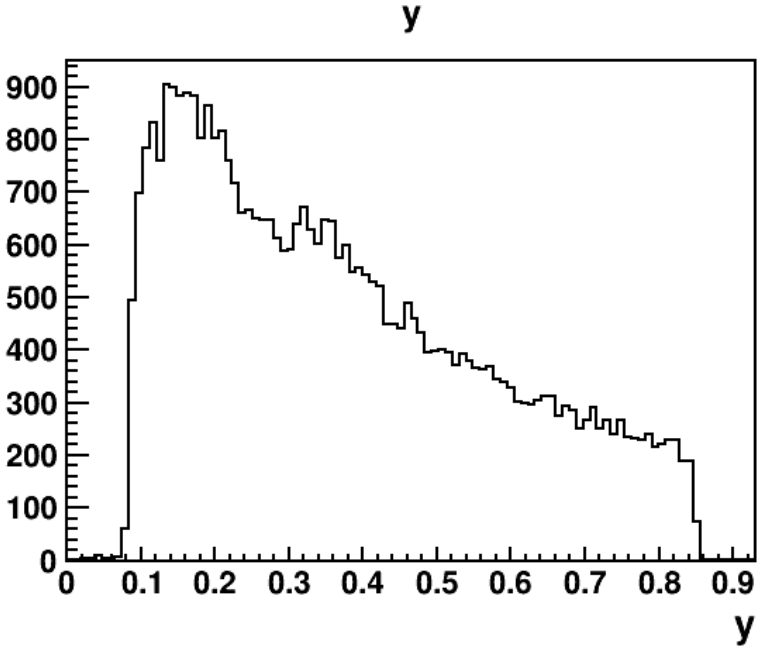
I can go into more depth at the next meeting depending on what people are most interested in.

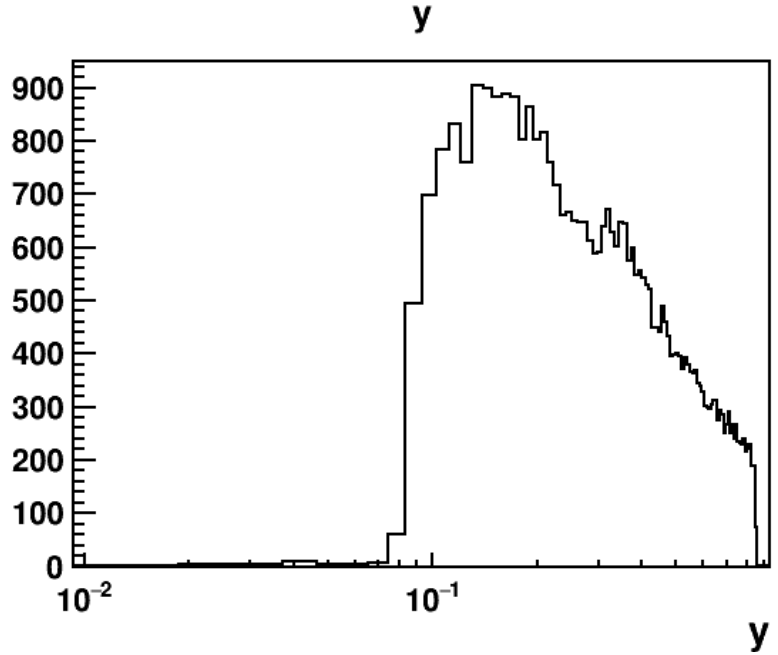
Fix BeAGLE ∞ loop for ymin=0

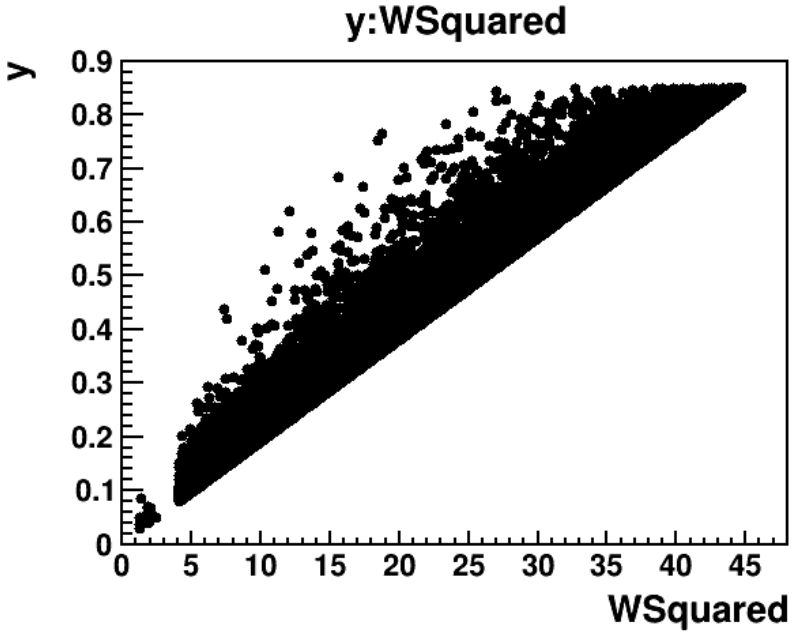


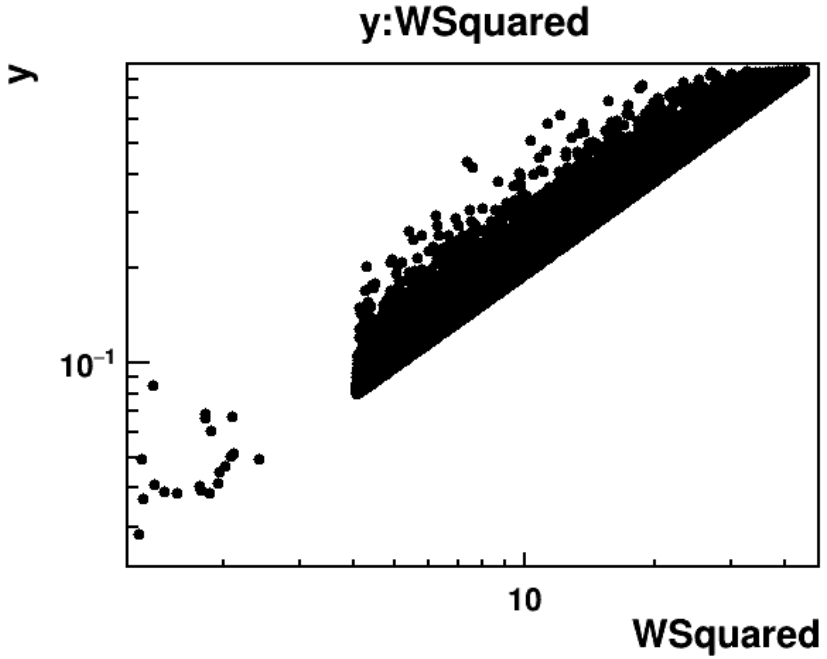
Note: Fix not yet released to main area. Not urgent. Just use explicit ymin.

HERMES kinematics limit y reach anyway

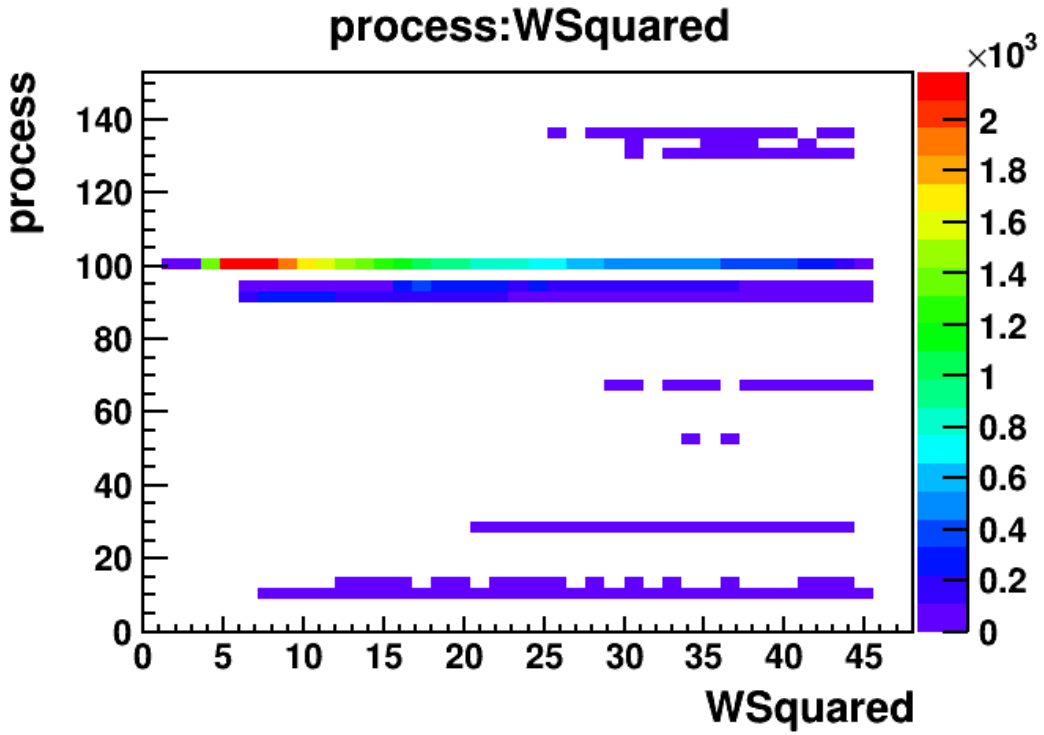


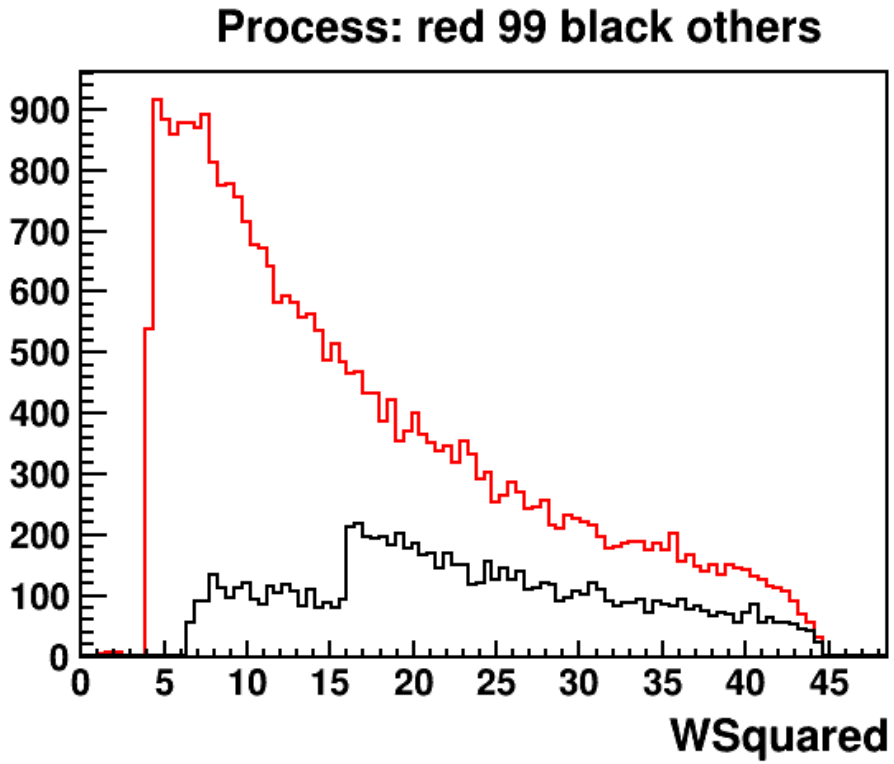






W^2 limit built into Pythia by process?



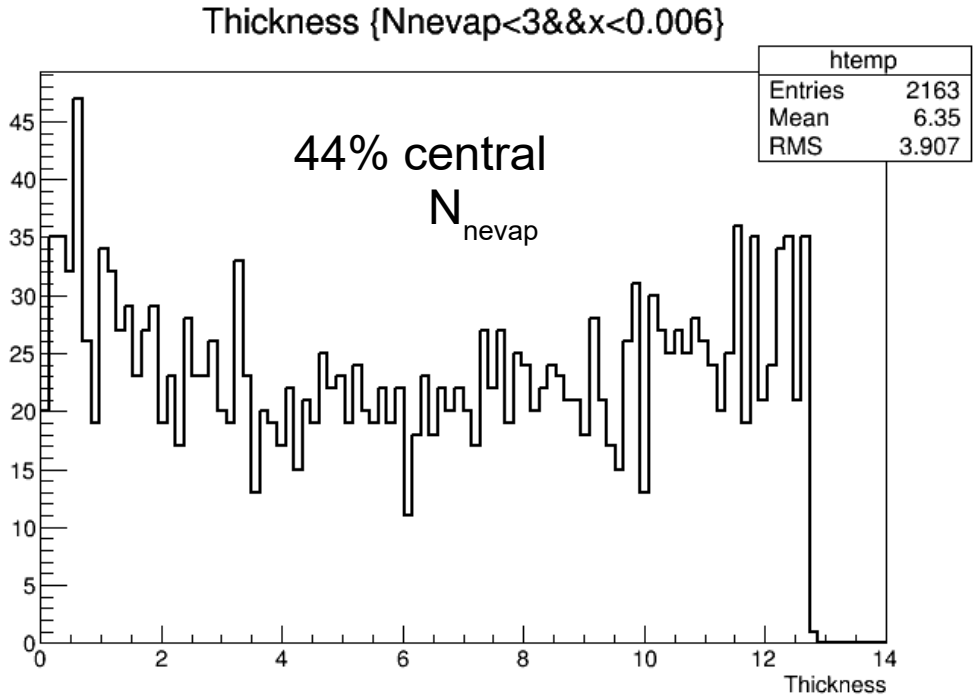


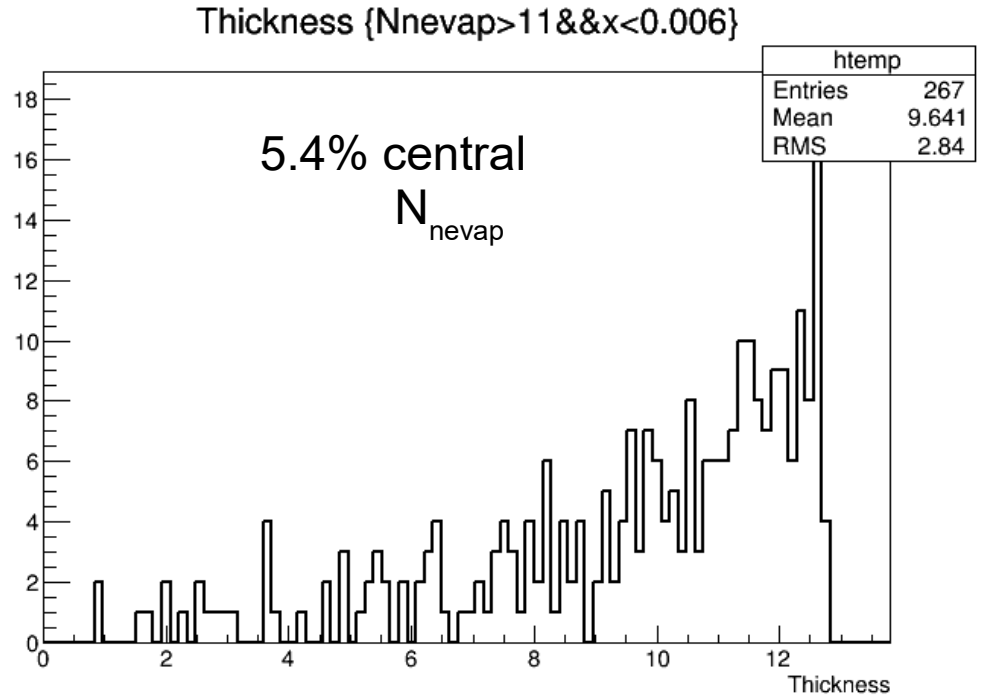
Natural 1st paper (pre-JLAB, post ZAL)

- BeAGLE vs. DPMJet
  - BeAGLE better than DPMJet for E665 vs. Q^2,W^2
    - I still owe E665 trigger explanation / sim. algorithm
  - We added multinucleon shadowing
- Improved outlook for measuring b (or T(b)) using ZDC only.
  - Possibly tighter cuts than 10% (how tight?)
    - Need to do cuts on E_{ZDC} (or $N_{clusters}$?), not N_{nevap}
  - Tune τ_0 to 7 fm since E665 neutron events include diffractive as well as DIS.
  - genShd>1 improves outlook at low x where we care

Tight cuts DO work for T(b)!

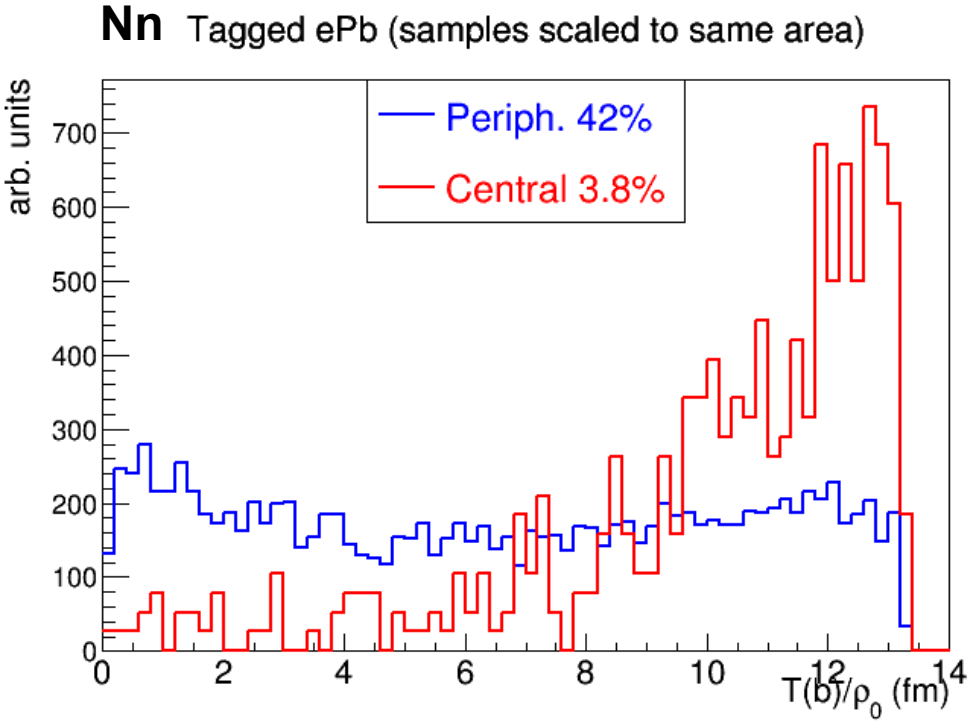
eAu 10x100 x<0.006, Q^2>1. genShd=3 (Shadowing & inelastic on first nucleon)

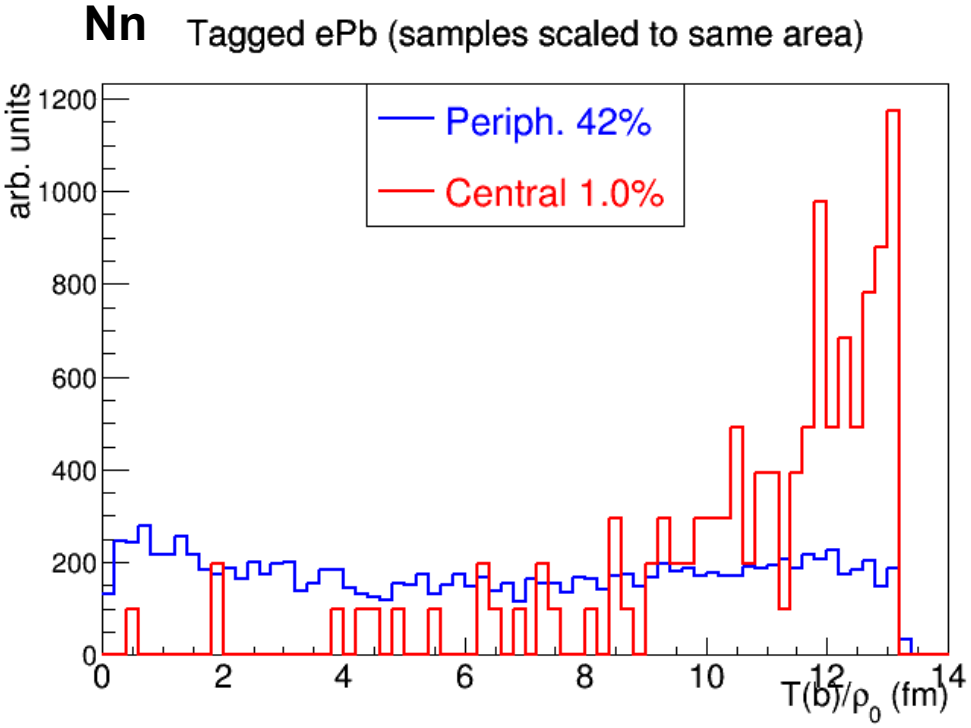




Overlaid plots for 10x40, x<0.003

ePb 10x40 x<0.003, Q^2>1. genShd=3 (Shadowing & inelastic on first nucleon)





$\langle T(b)\rangle_{cent}/\rho_0$ = 10.18 fm

$\langle T(b)\rangle_{cent}/\rho_0$ = 10.71 fm

Note: $\langle T(b)\rangle_{minbias}/\rho_0$ = 7.52 fm

Later paper or additions to first paper

- Include d? (probably in first paper)
  - Conceptual issues for multinucleon low x
- Include protons? Photons? ...?
  - Definitely starting to overlap/duplicate JLAB work which they started. Collaborate?
  - JLAB Morozov et al. group is in a similar status as we are for the b & d geometry tagging. Work is "mostly done", but needs a push to make a paper out of it.

Diffraction vetoing paper

- Here we really should try to join Vasiliy Morozov & Amy Sy (JLAB) at least* along with Tobias & Thomas.
- Sartre needs a final push by Vasiliy to get a reasonable set of e+Pb tables. Almost finished.
- Need to understand Tobias's G(b) fitting macros.
- JLEIC & eRHIC results will look pretty similar, I think. G(b) will probably look fine.

*- and probably a few others

Other/Future papers

- A general paper (or section of eRHIC document) on eRHIC forward capability in general: neutrons + protons + photons...
- A paper on the comparison between BeAGLE (w/ RAPGAP) & the E665 Streamer Chamber data.
  - Needs BeAGLE w/ RAPGAP to be finished (MDB)
  - Let's compare BeAGLE w/ E665 SC now anyway.

Tuning project (starts Febr. or March)

- Focus on ion remnant or target jet primarily
  - Soft particles (mostly nucleons) in fixed target
  - Very forward particles (in ion/hadron direction) @ collider
- Using standard (Pythia) BeAGLE
  - Confirm forward ZEUS protons & neutrons in e+p
  - Confirm E665 soft neutrons from μ+Pb (Ca?)
  - Check E665 full event charged from μ+Xe vs μ+D (Streamer Chamber) – single particle & rapidity gap
- Repeat w/ RAPGAP-based option in BeAGLE

Current JLAB LDRD effort focus on SRCs

- Led by Douglas Higinbotham, including Charles, Pawel & Or Hen. Postdoc: Florian Hauenstein.
- Long Island participation: Barak Schmookler & Kong (w/ Abhay & Thomas). Also me and Liang.
- Short-term goal: Quasi-elastic w/ SRCs from GCF(Generalized Contact Formalism) fed into BeAGLE for INC + FLUKAing.

Previous JLAB LDRD over but not dead

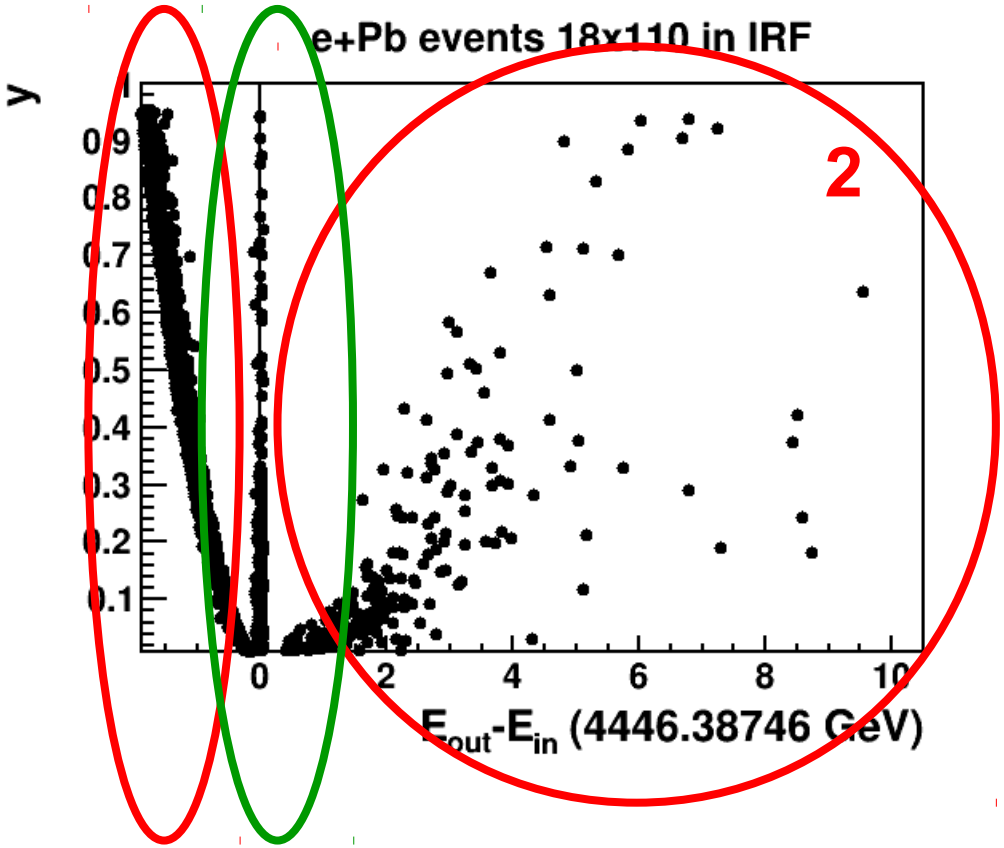
- Vasiliy Morozov is making useable sar*t*re tables.
- Raphaël Dupré and student Mathieu Ehrhart are tweaking PyQM
  - Already added small improvements since DPMJetHybrid days.
  - Already added dead-cone effect for heavy quarks
  - Working on allowing multi-gluon emission rather than always forcing 1 big gluon.

Energy (& charge) nonconservation!

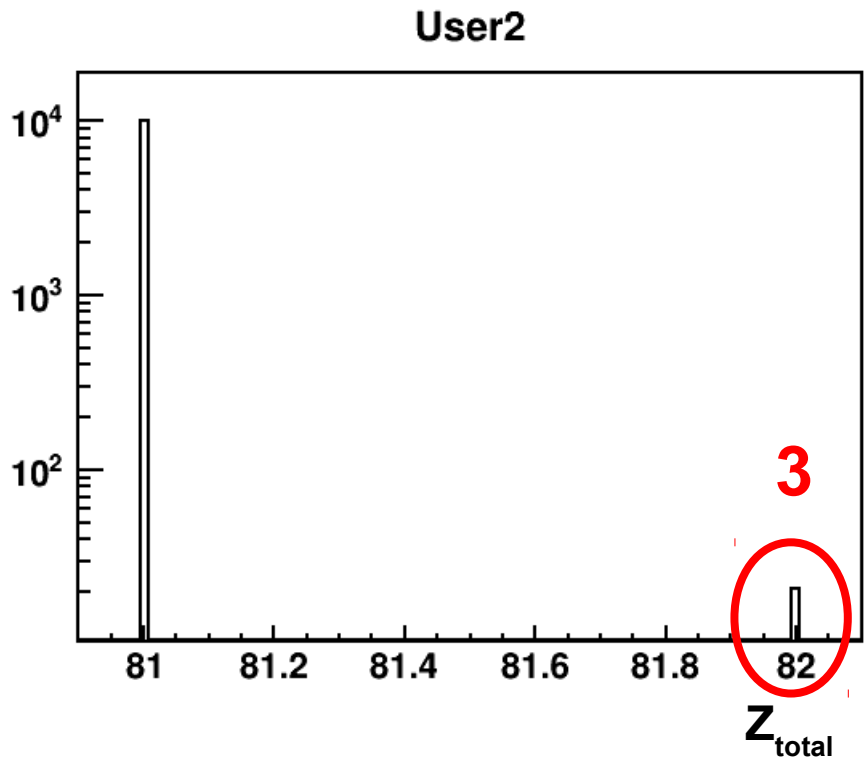
Discovered with Kong quite some time ago (August)!

The problem(s) in order of frequency

1 $E_{out} - E_{in}$ **should be zero**



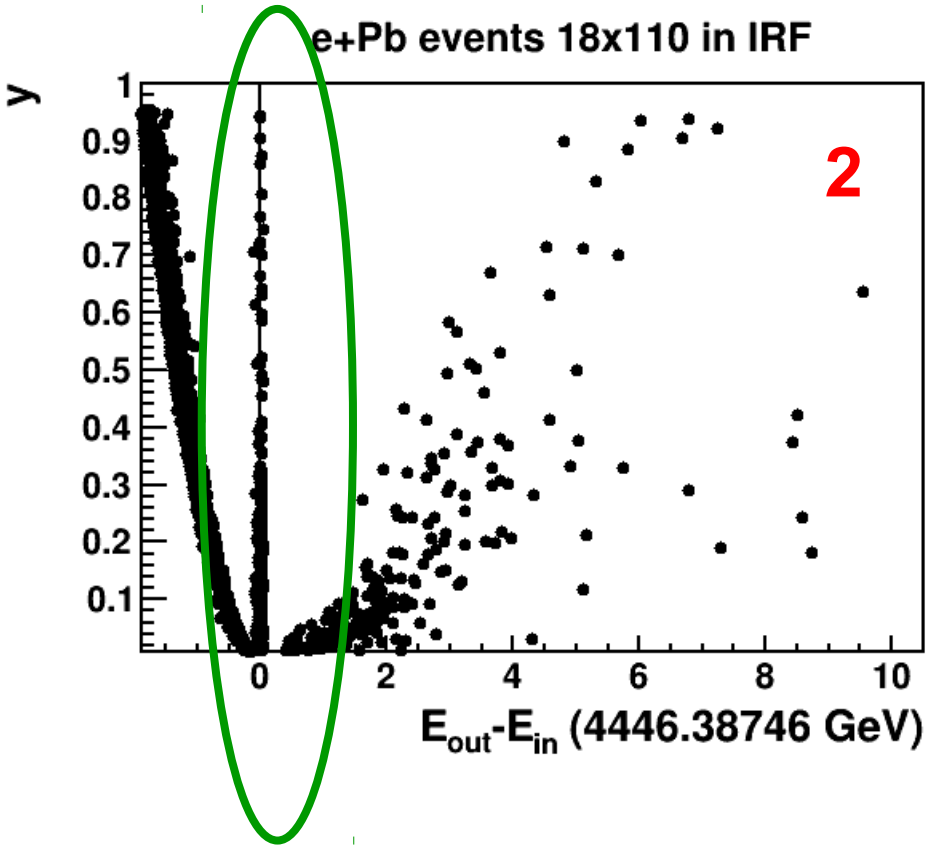
e- + $^{208}Pb_{82}$ **should add up to 81**

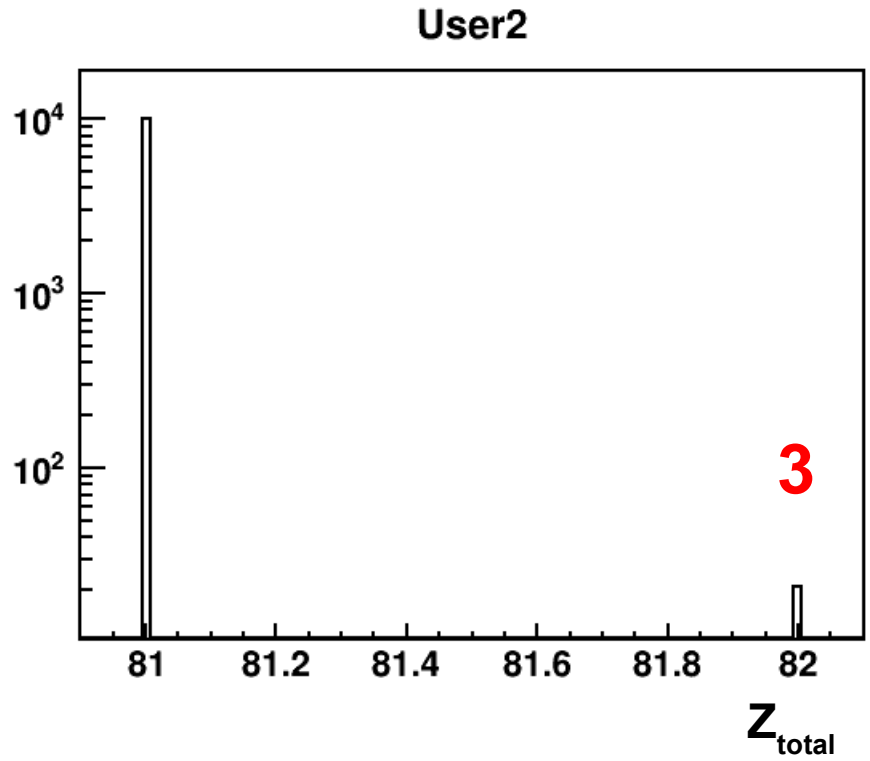


Nonconservation debugging progress

All good events are fission events,
But not vice versa. Some type 2 & 3 are fission too.
Fission does not have type 1.

1

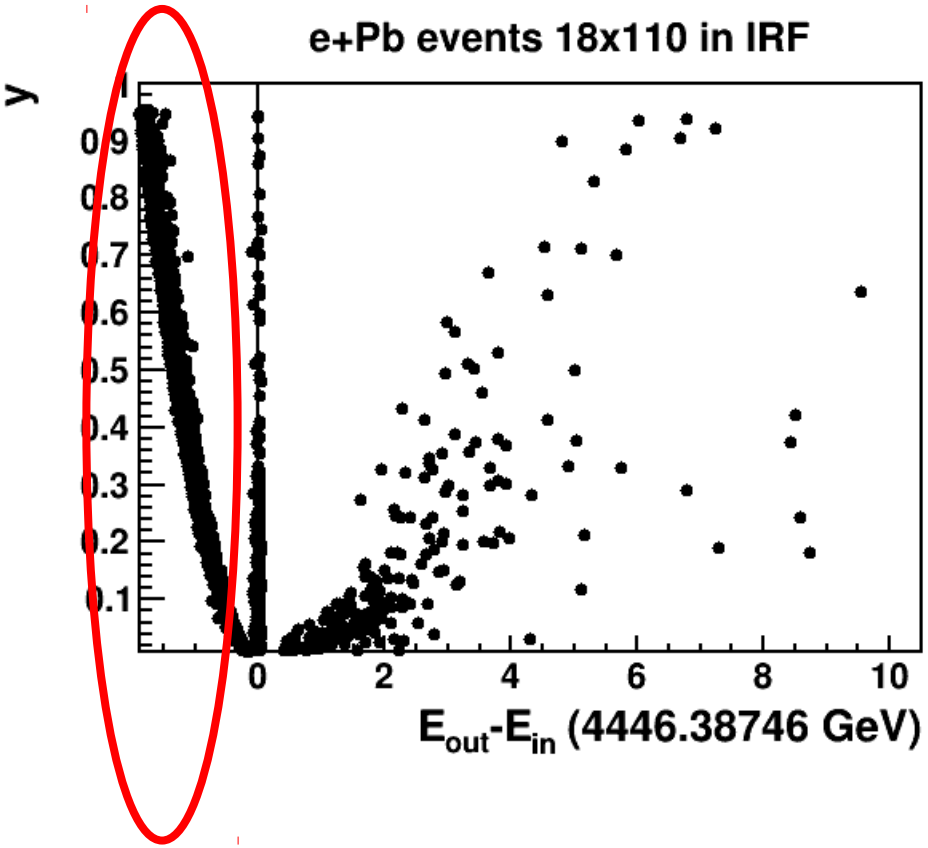


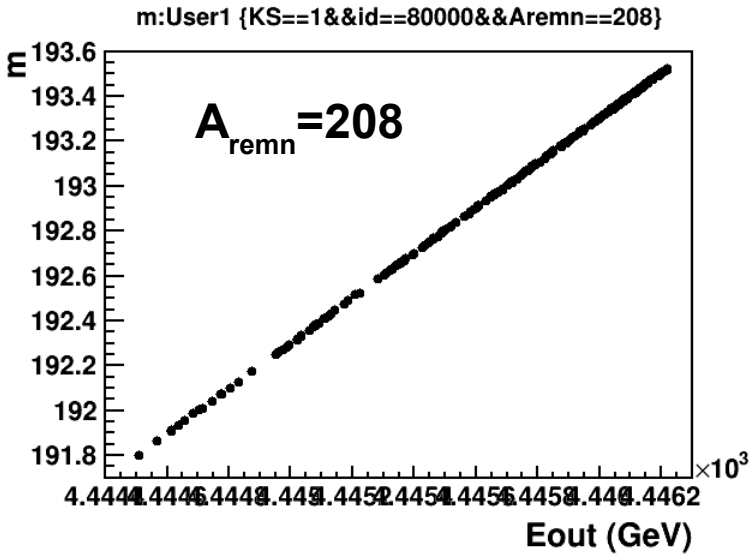


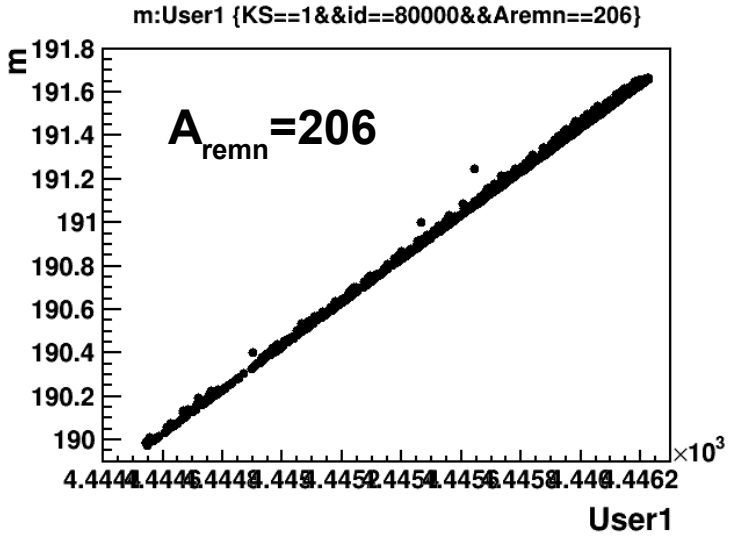
Nonconservation debugging progress

Type 1 events are due to the final (ground state) nuclear remnant mass being wrong:

1 $E_{out} - E_{in}$ **should be zero**



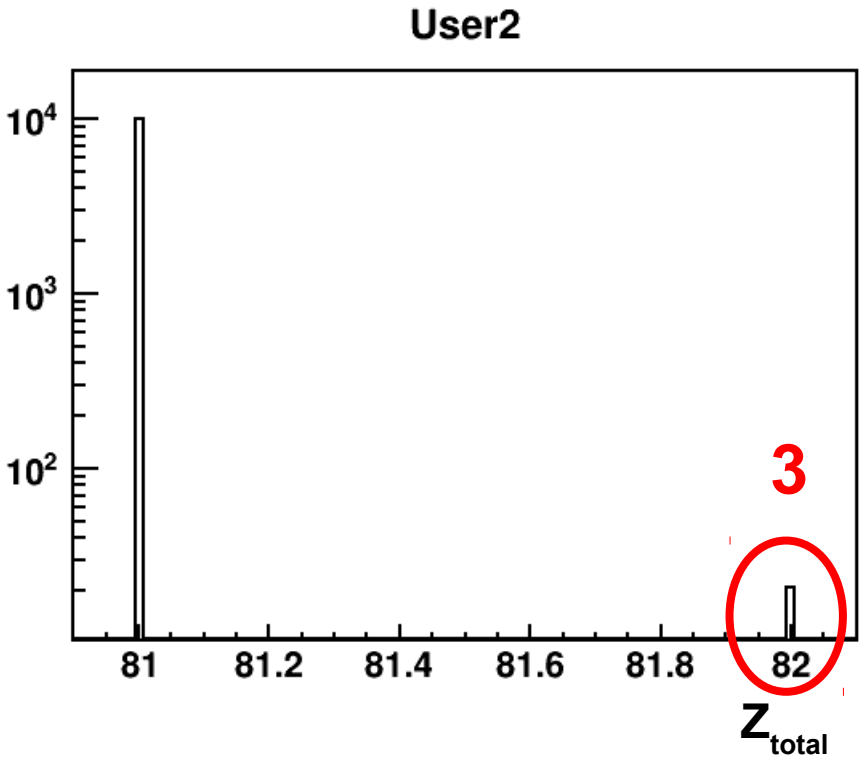




Nonconservation debugging progress

Type 3 (21/10000) appears to be due to hypernuclei!

e- + $^{208}Pb_{82}$ should add up to 81



DPMJET, and therefore BeAGLE, has no provision for hypernuclei. Does FLUKA?

And the logic is buggy:
If a nuclear remnant captures a Σ^-, the Σ^- is counted as a neutron (any baryon which is not a proton is counted as a neutron!).

Easy "fix": Σ^- + p treated as n + n + E*. Correct Z. Correct energy. But...

Proper handling of hypernuclei would be interesting, but would take time!

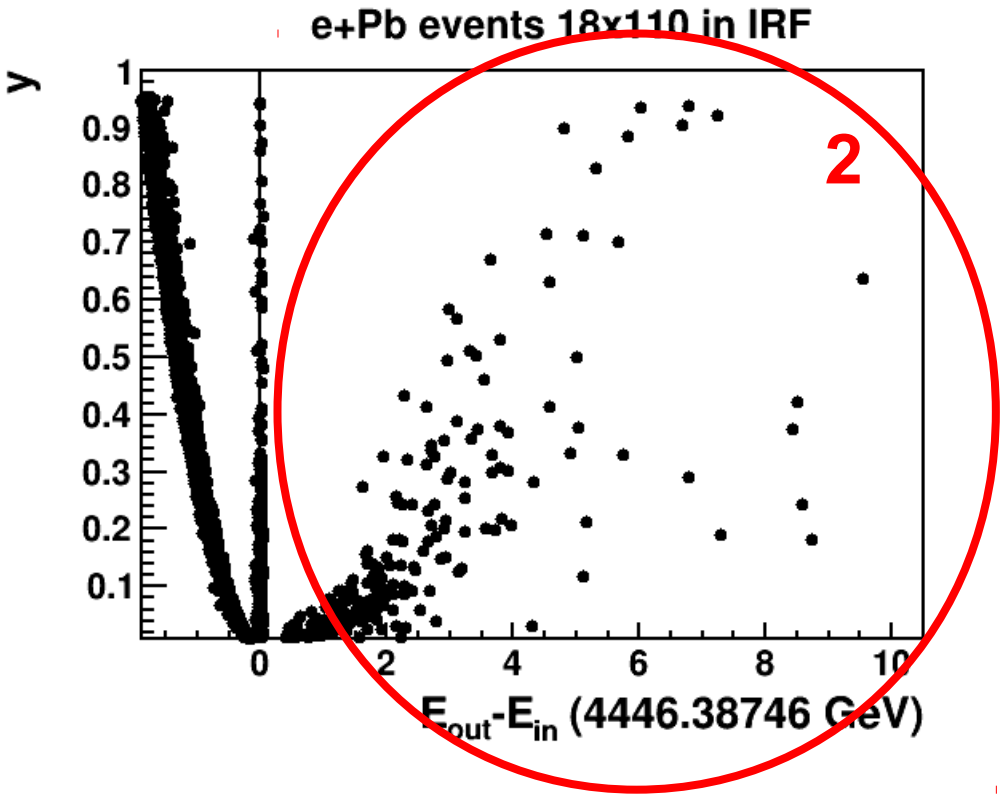
Working on charge conservation

- Added the capability of internally describing an intermediate hypernucleus.
  - A,Z,"Nhyper","IDHYP(5)" with
    - A,Z mean total baryon # and charge
    - Nhyper non-nucleonic baryons listed in IDHYP
- Simplest fix is to convert hypernucleus to same A,Z but with extra energy $E^*=M_{baryon}-M_N$
- It would be nice if we put better physics in, but...
- Hypernuclei not that rare! Could be interesting.

Nonconservation debugging progress

Haven't looked into type 2 yet...

$E_{out} - E_{in}$ should be zero



Conclusion

- Lots to do
  - Comparing to E665 & HERMES data
    - Other data a la JH? Which data again?
  - Start a physics paper?
    - Should we write a "software release note" of some sort? Just on the arXiv? Or publish it?
  - Debugging & adding RAPGAP